UNIVERSITI PUTRA MALAYSIA

THE EFFECT OF DIFFERENT POSTHARVEST TREATMENTS ON THE CHANGES IN THE PHYSICO-CHEMICAL CHARACTERISTICS AND MANIFESTATION OF CHILLING INJURY OF PISANG MAS (MUSASAPIENTUMVAR. MAS) DURING STORAGE AT LOW TEMPERATURE

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By

DWI FEBRIMELI

Thesis Submitted in Fulfilment of the Requirements for the Degree of Master of Science in the Faculty of Food Science and Biotechnology Universiti Putra Malaysia

January 2000

To my beloved parents.....

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Master of Science.

THE EFFECT OF DIFFERENT POSTHARVEST TREATMENTS ON THE CHANGES IN THE PHYSICO-CHEMICAL CHARACTERISTRICS AND MANIFESTATION OF CHILLING INJURY OF PISANG MAS (*MUSA SAPIENTUM* VAR. MAS) DURING STORAGE AT LOW TEMPERATURE

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January 2000

Chairman: **Associate Professor Azizah Osman, Ph.D**

Faculty: **Food Science and Biotechnology**

Preliminary studies on the effect of storage temperature and heat treatments on the physical characteristics were carried out on Pisang Mas (*Musa sapientum* var. Mas). Temperature 14±1°C; 65-83%RH was the most suitable storage temperature for Pisang Mas with respect to peel colour score and texture as compared to temperature 12°C and 15°C. In contrast to peel colour score and pulp: peel ratio, fruit texture decreased significantly ($P<0.05$) during storage. Heat treatments (hot air at 30, 40 and 50°C for 3 and 6 hours or dipping in hot water at 50°C for 2 minutes) reduced the manifestation of physical symptoms of chilling injury and extended the storage life of Pisang Mas by 2 weeks as compared to the control fruits. Effect of different postharvest heat treatments prior to low temperature storage were studied to reduce the manifestation of chilling injury of Pisang Mas during storage at low temperature and when held at ambient conditions thereafter. During low temperature

storage, untreated fruit were shown to have a significantly ($P<0.05$) higher manifestation of chilling injury. Fruits exposed to 30°C hot air for 3 hours could significantly ($P<0.05$) reduced chilling injury symptoms in Pisang Mas. Different postharvest heat treatments could not significantly extend the shelf life of Pisang Mas as compared to control. Peel colour, pulp colour, pulp: peel ratio, total soluble solids (TSS), titratable acidity (TA), TSS: TA ratio, total sugar, fructose, glucose and sucrose of fruit increased significantly ($P<0.05$) during storage, in contrast to fruit firmness, pH, ascorbic acid (AA), tannin and starch contents. Chilling injury was also evident in all treated fruit after 2 and 4 weeks at low temperature storage followed by storage at ambient conditions. However, fruits kept for 4 week at low temperature (LTS) had a lesser extent of chilling injury as compared to fruit kept for 2 weeks at LTS. Fruits kept for 2 and 4 weeks under LTS had a shelf life of 9 and 6 days respectively. The TSS, TSS: TA ratio, pH and AA of fruit increased significantly ($P<0.05$) for all treated fruits and control during storage. The firmness and starch content decreased significantly ($P<0.05$). On the other hand, TA and tannin content were found to fluctuate during storage. Different concentrations of methyl jasmonate in reducing chilling injury were studied in Pisang Mas. Concentration higher than 100 μM were found not to be significantly different in reducing symptoms of chilling injury. Although methyl jasmonate did not affect peel colour, nevertheless pulp colour was slightly affected. The TSS and pulp to peel ratio increased significantly ($P<0.05$) during storage. However, firmness, AA, TA, pH, tannin, starch and pectin contents of fruit from all treatments were found to be inconsistent during storage.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains.

PENGARUH PERLAKUAN LEPAS TUAI YANG BERBEZA KE ATAS PERUBAHAN CIRI-CIRI FIZIKO-KIMIA DAN PERKEMBANGAN KECEDERAAN SEJUK DINGIN BUAH PISANG MAS (*MUSA SAPIENTUM* VAR. MAS) SEMASA PENYIMPANAN PADA SUHU RENDAH

Oleh

DWI FEBRIMELI

January 2000

Pengerusi: **Professor Madya Dr. Azizah Osman**

Fakulti: **Sains Makanan dan Bioteknologi**

Kajian awal terhadap kesan suhu penyimpanan dan perlakuan haba ke atas ciri-ciri fizikal Pisang Mas (*Musa sapientum* var.Mas) telah dijalankan. Suhu 14±1°C: 65-85% RH adalah suhu penyimpanan yang paling sesuai untuk Pisang Mas berdasarkan skor warna kulit dan tekstur berbanding dengan suhu 12 dan 15°C. Manakala berbeza dengan skor warna kulit, nisbah isi kepada kulit dan tekstur buah berkurangan secara bererti ($P<0.05$) semasa penyimpanan. Perlakuan haba (udara panas pada suhu 30, 40 dan 50°C untuk 3 dan 6 jam atau pencelupan dalam air panas pada suhu 50°C selama 2 minit) telah mengurangkan simptom fizikal kecederaan sejuk dingin dan memanjangkan hayat simpanan buah Pisang Mas kepada lebih 2 minggu berbanding kawalan. Pengaruh erlakuan haba yang berbeza sebelum penyimpanan telah dikaji untuk mengurangkan kecederaan sejuk dingin buah Pisang Mas *(Musa sapientum* var.Mas) semasa penyimpanan pada suhu rendah dan

selanjutnya disimpan pada suhu bilik. Semasa penyimpanan suhu rendah, buah yang tidak diperlakukan

bererti ($P<0.05$). Buah yang didedahkan kepada udara panas pada suhu 30°C untuk jangka masa 3 jam telah mengurangkan simptom fizikal kecederaan sejuk dingin secara bererti ($P<0.05$). Perlakuan haba yang berbeza tidak dapat memanjangkan hayat simpanan buah Pisang Mas berbanding kawalan. Warna kulit, warna isi, nisbah isi kepada kulit, jumlah pepejal terlarut, keasidan tertitrat, nisbah pepejal terlarut kepada keasidan tertitrat, jumlah gula, fruktosa, glukosa dan sukrosa telah meningkat secara bererti ($P<0.05$) semasa penyimpanan, berbeza dengan kekerasan buah, pH, asid askorbik, tannin dan kandungan kanji buah. Kecedaraan sejuk dingin juga terjadi pada semua buah yang diperlakukan haba setelah disimpan selama 2 dan 4 minggu pada suhu rendah dan selanjutnya di simpan pada suhu bilik. Walau bagaimanapun, buah yang disimpan selama 4 minggu pada suhu rendah menunjukkan perkembangan kecederaan sejuk dingin yang paling rendah berbanding buah yang disimpan selama 2 minggu pada suhu rendah. Buah yang disimpan selama 2 dan 4 minggu pada suhu rendah mempunyai hayat simpanan 9 dan 6 hari masing-masing. Jumlah pepejal terlarut, nisbah pepejal terlarut kepada keasidan tertitrat, pH dan asid askorbik meningkat secara bererti ($P<0.05$) semasa penyimpanan untuk semua perlakuan haba dan kawalan. Manakala kekerasan buah dan kandungan kanji berkurangan secara bererti ($P<0.05$). Selain itu, keasidan tertitrat dan kandungan tannin didapati berubah-ubah semasa penyimpanan. Kepekatan methyl jasmonate yang berbeza untuk mengurangkan simptom fizikal kecederaan sejuk dingin juga telah dikaji pada Pisang Mas. Buah yang dicelup ke dalam 10 μM menunjukkan skor kecederaan sejuk dingin yang paling tinggi. Kepekatan yang lebih dari 100 μM didapati tidak memberi perbezaan yang bererti dalam mengurangkan simptom kecederaan sejuk dingin.

Perawatan methyl jasmonate tidak mempengaruhi warna kulit, tetapi memberikan sedikit kesan kepada warna isi. Jumlah pepejal terlarut dan nisbah isi kepada kulit meningkat secara bererti ($P<0.05$) semasa penyimpanan. Akan tetapi, bagi kesemua ujikaji, kekerasan, keasidan tertitrat, pH, asid askorbik, tannin, kandungan kanji, dan pektin telah didapati tidak konsisten semasa penyimpanan.

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I certify that an Examination Committee met on 20 January, 2000 to conduct the final examination of Dwi Febrimeli on her Master of Science thesis entitled "The Effect of Different Postharvest Treatments on the Changes in the Physico-chemical Characteristics and Manifestation of Chilling Injury of Pisang Mas (*Musa sapientum* var. Mas) during Storage at Low Temperature" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

SALMAH YUSOF, Ph.D.
Associate Professor
Faculty of Food Science and Biotechnology
Universiti Putra Malaysia
(Chairman)

AZIZAH OSMAN. Ph.D
Associate Professor
Faculty of Food Science and Biotechnology
Universiti Putra Malaysia
(Member)

RUSSLY ABDUL RAHMAN, Ph.D
Associate Professor
Faculty of Food Science and Biotechnology
Universiti Putra Malaysia
(Member)

SUHAILA MOHAMED, Ph.D.
Professor
Faculty of Food Science and Biotechnology
Universiti Putra Malaysia
(Member)

MOHD. GHAZALI MOHAYIDIN, Ph.D.
Professor/Deputy Dean of Graduate School

Date: 14 MAR 2000

This thesis was submitted to the Senate of Universiti Putra Malaysia and was accepted as fulfillment of the requirements for the degree of Master of Science.

KAMIS AWANG, Ph.D.
Associate Professor/Dean of Graduate School
Universiti Putra Malaysia

Date: 11 MAY 2000

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citation, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Putra Malaysia or other institutions.

DWI FEBRIMELI

Date: 14/3/2000

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